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Part II

Department of Transportation

Federal Highway Administration

Design and Construction Criteria for Bikeway Construction Projects

DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

23 CFR Parts 625, 652 and 663

[FHWA Docket No. 79-3, Notice 2]

Design and Constructon Criteria for Bikeway Construction

AGENCY: Federal Highway Administration (FHWA), DOT.

ACTION: Notice of proposed rulemaking

SUMMARY: The Federal Highway Administration (FHWA), is issuing this notice of proposed rulemaking (NPRM) to request comments on proposed design and construction criteria for bikeway construction projects. the FHWA has developed a draft entitle "Guide for Bicycle Facilities" as the criteria for Federal-aid bikeway projects. This NPRM proposes to incorporate by reference these criteria in current FHWA regulations. Comments on specific elements of the criteria are requested.

DATE: Comments must be received on or before November 3, 1980.

ADDRESS: Comments should be sent (preferably in triplicate) to FHWA Docket No. 79-3, Notice No. 2, Federal Highway Administration, HCC-10, Room 4205, 400 Seventh Street, SW., Washington, D.C. 20590. All comments received will be available for examination at the above address between 7:45 a.m. and 4:15 p.m. ET, Monday through Friday. Those desiring notification of receipt of comments must include a self-addressed, stamped postcard.

FOR FURTHER INFORMATION CONTACT: Jim Kirschensteiner, Highway Design Division, Office of Engineering (202-426-0314), or Reid Alsop, Office of the Chief Counsel (202-426-0800), Federal Highway Administration, 400 Seventh Street, SW., Washington, D.C. 20590. Office hours are from 7:45 a.m. to 4:15 p.m. ET, Monday through Friday.

SUPPLEMENTARY INFORMATION: Pursuant to Section 141(b) of the Surface Transportation Assistance Act of 1978 (Pub. L. 95-599, 92 Stat. 2689), the FHWA is updating its existing criteria for the design and construction of bikeway projects. The FHWA proposes to amend the existing regulations 23 CFR 625, Design Standards for Highways; 23 CFR 652, Pedestrian Facilities and Bikeways, and 23 CFR 663, Bicycle Grant Program. All references in those regulations to the publication of the American Association of State Highway and Transportation Officials (AASHTO) entitled "Guide for Bicycle Routes" (1974) would be deleted and reference to the proposed document, "Guide for Bicycle Facilities," would be added. In addition, the definitions currently contained in Part 652 would be amended to reflect the definitions proposed in the FHWA guide. This proposed "Guide for Bicycle Facilities" contains the criteria which would be followed for developing bikeway projects funded under FHWA programs.

It should be noted that the proposed FHWA guide does not set forth standards in the strictest sense of the word, but rather contains guidelines. The FHWA has developed the "Guide for Bicycle Facilities" to provide general program direction. The guide recommends criteria that are valuable in attaining good design, and that should be met when designing and constructing bicycle facilities. In addition, the guide includes information on planning, operating, and maintaining bicycle facilities.

An advance notice of proposed rulemaking (ANPRM) for developing design and construction criteria was published on February 8, 1979 (44 FR 7979). Comments were specifically requested regarding the criteria that should be included in bikeway design and construction standrds, and the FHWA's existing criteria in the AASHTO "Guide for Bicycle Routes."

Fifty-two comments were submitted. These included 14 from State agencies, 12 from local government agencies, seven from bicycle groups, five from consultants, nine from citizens, three from associations, one from a corporation, and one from a Federal agency.

Commenters generally supported the development of criteria for bicycle design and construction projects. Some indicated that the AASHTO guide had served their needs adequately; however, a more current design document was needed. Most commenters included suggestions about what criteria should be included in a new publication. The document "Planning and Design Criteria for Bikeways in California" (State of California, Department of Transportation, 1978) was mentioned frequently as an up-to-date source of information on bicycle facilities. Comments were received concerning the need to include details about bicycle transportation planning, bicyle parking facilities, and roadway improvements for bicycles. Several commenters stated that any new document should not contain strict requirements but should give flexibility to State and local agencies.

The criteria now being proposed for adoption are contained in the draft "Guide for Bicycle Facilities", which is included in this NPRM. The FHWA has developed this guide by using comments received in response to the ANPRM and by referring to the AASHTO "Guide for Bicycle Routes" (1974) and other available information such as the "Manual on Uniform Traffic Control Devices" (FHWA, 1978), "A Bikeway Criteria Digest" (FHWA, 1977), and "Planning and Design Criteria for Bikeways in California," (State of California, Department of Transportation, 1978).*

The provisions of title 23 of the United States Code provide for a federally assisted State program. In furtherance of the objectives of this program and in accordance with the general purposes of title VI of the Intergovernmental Cooperation Act of 1968 (Pub. L. 90-577, 82 Stat. 1098), the development of the bikeway criteria will be carried out in full cooperation with the States. Copies of the proposed guide are being provided directly to the States. In addition, copies of the proposed guide are being provided to the 52 persons who commented on the ANPRM. The FHWA would prefer to see the guide's criteria apply to all bikeway projects nationwide rather than having separate criteria apply based on the type of funding available. Accordingly, following analysis of all comments received as a result of this NPRM and appropriate revision of the proposed guide, the FHWA anticipates requesting AASHTO officials to adopt the guide and promote the use of its criteria on State and locally funded bicycle projects.

Note.—The FHWA has determined that this document does not contain a significant proposal according to the criteria established by the Department of Transportation pursuant to Executive Order 12044. The proposed guide would not impose mandatory standards on State and local governments, but would provide general program direction and recommended criteria. The anticipated economic impact of this proposal is so minimal as not to require preparation of a full regulatory evaluation.

(Catalog of Federal Domestic Assistance Program No. 20.205, Highway Research, Planning, and Construction. The provisions of OMB Circular No. A-95 regarding State and local clearinghouse review of Federal and federally assisted programs and projects apply to this program)

*Copies of these documents are available for inspection at the FHWA Washington Headquarters and at all FHWA division and regional offices as prescribed in 49 CFR Part 7, Appendix D.

Issued on: July 25, 1980.

John S. Hassell, Jr.,

Federal Highway Administrator.

In consideration of the foregoing, the FHWA proposes to amend the following sections of title 23, Code of Federal Regulations:

§ 625.3 [Amended]

1. Amend § 625.3(e) by adding a new paragraph (3) to read as follows:

(3) "Guide for Bicycle Facilities," FHWA, 1980.[3]

(23 U.S.C. 109, 315, and 402; 49 CFR 1.48(b)

2. Amend Part 652 by changing the definitions in § 652.3(a) through (e) to read as follows:

§ 652.3 Definitions.

(a) Bicycle. A vehicle having two tandem wheels, propelled solely by human power, upon which any person may ride.

(b) Bikeway. Any road, path, or way which in some manner is specially designed as being open to bicycle travel, regardless of whether such facilities are designated for the exculsive use of bicycles or are to be shared with other transportation modes.

(c) Bicycle path. A bikeway physically separated from motorized vehicluar traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way.

(d) Bicycle lane. A portion of a roadway which has been designated for the preferential or exclusive use by bicycles.

(e) Bicycle route. A roadway designated for bicycles by signing only.

* * * * *

3. Amend Part 652 by adding a new heading to the table of sections to read "§ 652.11 Design criteria." and by adding the corresponding section within the Part to read as follows:

§ 652.11 Design criteria.

Current FHWA design and construction criteria for bikeways (23 CFR 625) or equivalent criteria approved by the FHWA Division Administrator shall apply.

(23 U.S.C. 217, 315 and 402(b)(1)(F); 109, 152, and 49 CFR 1.48)

4. Amend Part 663 by revising § 663.7 to read as follows:

§ 663.7 Construction criteria.

Current FHWA design and construction criteria for bikeways (23 CFR part 625) or equivalent criteria approved by the FHWA Division Administrator shall apply.

(Sec. 141, Pub. L. 95-599, 92 Stat. 2711; 23 U.S.C. 315; 49 CFR 1.48(c)(1))

Note.—The following text of the draft document "Guide for Bicycle Facilities," FHWA, 1980, is proposed to be incorporated by reference and will not appear in the CFR.

Guide for Bicycle Facilities

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Introduction

Throughout the United States the bicycle is regarded as a viable mode of transportation. Since the early 1970's, bicycling for commuting, for recreation, and for other travel purposes has increased in popularity. Nationwide, people recognize the energy efficiency, the economy, the health benefits, and the many other advantages of bicycling.

Local, State, and Federal agencies are responding to the increased use of bicycles by implementing a wide variety of bicycle-related projects and programs. The emphasis now being placed on bicycle transportation requires an understanding of bicycles, bicycle riders, and bicycle facilities. The bicycle, if adequately planned for and utilized, can fill a role in the overall transportation system.

Purpose

Safe and adequate facilities are essential to encourage bicycle riding. The purpose of this guide is to provide information on the development of facilities to enhance safe bicycle travel. Bicyclists ride almost everywhere—on highways, sidewalks, and bikeways.

This guide provides information to help accommodate bicycle traffic in all riding environments.

Chapter 1 provides an overview of planning considerations for bicycles, a discussion of the types of facility improvements, and a description of the factors to consider when locating a facility. Chapter 2 provides guidelines to follow when designing and constructing bicycle facilities. Chapter 3 provides recommendations on the operation and maintenance of facilities for bicycles. The appendix provides a review of the legal status of bicycles.

Scope

This guide provides part of the information necessary to provide for a safe bicycling environment. Facilities are only one of the several elements essential to a community's overall bicycle program. Bicycle safety education and training, bicycle use encouragement, and bicycle rules-of-the-road and their proper enforcement should combine with facilities to form a comprehensive community approach to bicycle use. This guide provides information on facilities. Information on other elements of an overall bicycle program can be found in other publications.

The provisions for bicycle travel are consistent with and similar to standard highway engineering practices. Signs, signals, and markings for bicycle facilties which are presented in the *Manual on Uniform Traffic Control Devices* (MUTCD) should be used in conjunction with this guide. State specifications for the construction of roads and bridges are applicable to bicycle facilties and should be consulted when constructing projects.

Definitions

Bicycle—A vehicle having two tandem wheels, propelled solely by human power, upon which any person may ride.

Bikeway—Any road, path, or way which in some manner is specifically designated as being open to bicycle travel, regardless of whether such facilties are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

Bicycle (bike) path—A bikeway physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way.

Bicycle (bike) lane—A portion of a roadway which has been designated for

the preferential or exclusive use by bicycles.

Bicycle (bike) route—A roadway designated for bicycles by signing only.

Roadway—The portion of the highway, including shoulders, for motor vehicle use.

Chapter 1—Planning

Bicycle planning is commonly thought of as the effort undertaken to develop a bikeway system—bicycle paths, lanes, and routes—all interconnected and spaced closely enough to satisfy the travel needs of bicyclists. In fact, such systems would be prohibitively expensive. Scaled-down systems, as currently implemented, do not provide for the vast majority of bicycle travel. Existing roads, together with bikeways, must serve as the system to provide for the travel needs of bicyclists. Thus, bicycle transportation planning is more than planning for bikeways and is an effort that should consider many alternatives to providing for safe and efficient bicycle travel.

Planning for bicycles must be conducted in conjunction with planning for other transportation modes. Often an improvement which enhances bicycle travel will also benefit other modes of travel. Conversely, highway improvements through appropriate planning and design can enhance bicycle travel. Plans for implementing bicycle projects must be in harmony with a community's overall goal for transportation improvements.

The differences among bicyclists' ages, abilities, and purposes for riding must be understood before planning for bicycle transportation improvements. In general, bicycle trip purposes can be divided into two types, utilitarian and recreational. For a bicyclist on a utilitarian trip, the primary objective is reaching a specific destination quickly with few interruptions. The bicycle is merely a cheap and efficient means of transportation. On the other hand, a bicyclist on a recreational trip is riding for pleasure.

Planners must also realize that bicyclists differ widely in their abilities and in their preference of riding environments. Skillful and confident bicyclists often prefer the directness and speed of riding arterial streets and have the ability to ride safely and efficiently in heavy traffic. Other bicyclists are not so confident and are willing to go out of their way to ride on residential streets or bikeways. It is essential that the characteristics of the different types of bicyclists are understood. Improvements and facilities must be planned to accommodate the type of bicyclist expected to utilize the facility.

Inventory of Existing Conditions

The planning for bicycles begins with observing and gathering data on the existing conditions for bicycle travel. Problems, deficiencies, hazards, and the needs of bicyclists must be identified. The existing bicycling environment should be observed. Bikeways, roadways where bicyclists ride, and roadways where bicyclists do not ride should be examined for their suitability for bicycling. Hazards on existing highways, such as unsafe grates, debris, shoulder rumble strips, narrow lanes, driveways, rough pavements, high speed or high traffic volume, high truck volume, and traffic signals nonresponsive to bicycles should be considered for their effect on bicycling. The existing bicycle parking situation should be examined for its adequacy.

Areas near bicycle traffic generators, such as major employment centers, schools, parks, and shopping centers, should be reviewed to identify existing or potential bicycle travel. Convenient access for bicyclists to mass transit stations and other intermodal transfer points should be checked. Barriers, such as rivers and freeways, should be examined for their effects on bicycling.

Bicycle accident locations should be investigated to identify any physical hazard which may have contributed to the accident. Data on the amount of recreational versus utilitarian riding, and on the ages and experience of bicyclists, should be collected.

Public participation is essential during the inventory of existing conditions. Obsevations and surveys of active bicyclists and the views of the nonbicycling public should be solicited. the attitudes and needs of the skilled and experienced bicyclist greatly differ from those of the casual or potential bicyclist. Thus, a wide variety of views should be sought. A citizen bicycle advisory committee can be a good source of information.

Besides the inventory of physical factors affecting bicycle transportation, education and enforcement programs should be examined for their effectiveness.

Analysis of Improvements

Bicycle use goals and objectives should be in harmony with the overall transportation policy of the community or State. The inventory of existing conditions provides an opportunity to modify or refine bicycle use goals and objectives. With established goals and objectives in hand, the existing conditions are analyzed and a plan is developed. Programs and projects for bicycle user encouragement, enforcement, education, and facility improvements are all options that should be considered. The end result is a plan of suggested improvements for bicycle travel.

When developing a plan, a wide range of facility improvements should be considered. Roadway improvements and maintenance, bikeways, and bicycle parking devices should all be considered.

Roadway and roadway maintenance improvements can reduce conflicts between pedestrians, bicyclists, and motorists and can improve conditions unsafe for bicycle riding. In rural areas, shoulder improvements and signing can be helpful for accommodating expected bicycle traffic. In urban and some rural areas, improvements to drainage grates, railroad grade crossings, pavement surfaces, traffic signals, signing, and marking can be beneficial on roadways where bicycles are anticipated.

Bicycle routes can provide continuity to other bicycle facilities or designate a preferred route.

Bicycle lanes can improve conditions in corridors where there is significant bicycle demand. Delineating the rights-of-way by signs and pavement markings can provide for more predictable movements by motorists and bicyclists.

Bicycle paths can provide enjoyable recreational opportunities and, in some instances, desirable commuter routes. Bicycle paths can create opportunities not provided by the road system.

Sidewalks are generally not acceptable for bicycling; however, in a few limited situations, such as on long and narrow bridges and in residential areas where young inexperienced children are the primary riders, sidewalk improvements can be beneficial.

Bicycle parking devices are essential to encourage utilitarian bicycling. Bike parking should offer protection from theft, weather, and damage. Such devices should be located at mass transit stations to encourage intermodal travel.

Selection of a Facility

When a facility improvement is desired, its basic purpose (e.g., utilitarian use versus recreational use) and the following factors should be considered to determine its type, location, and priority;

1. Barriers—In some areas, there are physical barriers to bicycle travel, caused by topographical features, freeways, or other impediments. In such cases, providing a facility to overcome a barrier can create new opportunities for bicycling.

2. Accidents—The occurrence of bicycle accidents (i.e. bicycle/motor vehicle, bicycle/bicycle, bicycle/pedestrian and single bicycle accidents) along routes is important. The potential for alleviating accident problems through the improvement of a facility should be assessed, as should the potential for introducing new accident problems.

3. Directness—for utilitarian bicycle trips, facilities should serve traffic generators and should be located along a direct line convenient for users.

4. Access—In locating a bicycle path, consideration should be given to the provision for frequent and convenient access, especially in residential areas. this is important to both recreational and utilitarian riders. Adequate access for emergency and service vehicles should also be considered.

5. Attractiveness—The scenic value is particularly important along a facility intended to serve a recreational purpose.

6. Security—The potential for criminal acts against bicyclists, especially along remote bicycle paths, and the possibility of theft or vandalism at parking locations should be considered.

7. Delays—Bicycle travel is inherently slower than motor vehicle travel. If bicyclists are required to make frequent stops, they will generally avoid the route.

8. Use conflicts—different types of facilities introduce different types of conflicts. Facilities on the roadway can involve conflicts between bicyclists and motor vehicles. Bicycle paths can involve conflicts between bicyclists and pedestrians on the facility and between bicyclists and motor vehicles at highway and driveway intersections.

9. Maintenance—Ease of Maintenance is important when locating facilities. If a facility is not adequately maintained, it may prove a poor investment.

10. Pavement surface quality—A facility located on the roadway must have a smooth pavement. Utility covers and drainage grates should be at grade. Approaches to railroad crossings should be improved as necessary to provide for safe bicycle crossings.

11. Truck and bus traffic—Because of their aerodynamic effect and width, high-speed trucks, buses, motorhomes, and trailers can cause special problems for bicyclists.

12. On-street parking—the turnover and density of on-street parking can effect the safety of bicyclists (e.g., opening car doors, and cars leaving angle parking spaces).

13. Traffic volumes and speeds—for facilities on the roadway, traffic volumes and speeds must be considered along with the roadway width. Commuting bicyclists frequently use arterial streets because they minimize delay and offer continuity for trips of several miles. It can be more desirable to improve heavily traveled high-speed streets than adjacent streets, if adequate width for all vehicles is available on the more heavily traveled street. When this is not possible, a nearby parallel street may be improved for bicyclists, if stops are minimal and the route conditions are adequate. In general, inexperienced bicyclists will not ride on heavily traveled high speed arterials but will prefer quieter streets.

14. Cost/Funding—Location selection will normally involve a cost analysis of alternatives. Funding availability can limit the alternatives; however, it is important that a lack of funds not result in a poorly designed or constructed facility. If only a small amount of funds is available, emphasis should usually be given to low-cost improvements (e.g., bicycle parking, removal of barriers to bicycle travel, roadway improvements, and nonconstruction projects).

Chapter 2—Design

There is a wide range of facility improvements which can enhance bicycle transportation. Improvements can be simple and involve minimal design consideration (e.g., changing drainage grate inlets) or they can involve a detailed design (e.g., providing a bicycle path). The controlling feature of the design of every bicycle facility is its location. Roadway improvements such as bicycle lanes depend on the roadway's design. On the other hand, bicycle paths are located on an independent alignment; consequently, their design depends on many factors, including the performance capabilities of the bicyclist and the bicycle. Guidelines are presented to help design and construct both roadway improvements and separate paths for bicycles.

Roadway Improvements

Bicycles are and will be ridden on many highways. Because most highways have not been designed with bicycle travel in mind, there are many ways in which a roadway could or should be improved when bicycle traffic is expected. Some roadway conditions—safe drainage grates and railroad crossings, smooth pavements, and signals responsive to bicycles—should be provided. In addition, facilities such as bicycle lanes, bicycle routes, shoulder improvements, and wide curb lanes should be considered. Information on each of the different roadway improvements is included.

Drainage Grates—Drainage inlet grates and utility covers are potential problems to bicyclists. When a roadway is being resurfaced, it is important that grates and utility covers be flush with the surface. Most parallel drainage inlet grates allow narrow bicycle tires to drop into the grates, which is extremely hazardous for bicyclists. These and other hazardous grates should be replaced with bicycle-safe and hydraulically efficient ones. When this is not immediately possible, consideration should be given to welding 1-inch x ¼-inch (25mm x 6mm) steel cross straps 4 inches (102mm) apart on centers, or to identifying the grate with a pavement marking as indicated in the MUTCD. Drainage grates on planned highways where bicycles are expected should always be bicycle safe.

Railroad Crossings—Railroad-highway crossings can be a hazard to bicyclists. Crossings should ideally be at a right angle to the rails. Consideration should be given to the materials of the crossing surface and to the flangeway depth and width. When a crossing clearly poses a hazard to bicyclists and cannot be improved, warning signs should be installed in accordance with the MUTCD.

Pavements—Pavement surfaces should be smooth and free of potholes. The edge of the pavement should be uniform. Narrow slots in the surface that could catch a bicycle wheel, such as a gap between two concrete slabs, should not be more than ½-inch (13mm) wide. Ridges in the pavement that could cause bicyclists to lose control, such as the joint between the pavement and a concrete gutter or utility cover, should not be more than ⅜-inch (10mm) high when parallel to travel or ¾-inch (19mm) high when perpendicular to travel.

Signals—At intersections where significant bicycle travel exists or is anticipated, bicyclists should be considered in the timing of the traffic signal cycle, as well as the traffic detection device. Normally, a bicyclist can cross an intersection under the same signal phasing arrangement as motor vehicles; however, on multi-lane streets special consideration should be given to ensure that short clearance intervals are not used. If necessary, an all-red clearance interval may be used. To check the clearance interval, a bicyclist's speed of 10 m.p.h. (16km/h) and a perception/reaction/braking time of 1.8 seconds should be used. Detectors for traffic-actuated signals should be sensitive to bicycles and should be located in the bicyclist's expected path.

Shoulders—If it is anticipated that bicyclists will ride on shoulders, a smooth surface should be provided. Pavement edge lines should be used instead of surface texture to delineate the shoulder from the travel lanes. Rumble sections should not be used on a shoulder if bicycle traffic is expected. Shoulder width should be a minimum of 4 feet (1.2m) to accommodate bicycle travel. If motor vehicle speed exceeds 35 m.p.h. (56km/h), if bicycle lanes are delineated, or if the percentage of trucks, buses, and recreational vehicles is high, then additional width is desirable. Improving the shoulders can often be the best way to accommodate bicyclists in rural areas.

Wide Curb Lanes—In urban areas, a right lane wider than 12 feet (3.7m) can be beneficial to bicyclists as well as motorists. Bicycles and motor vehicles can be better accommodated in the same lane. In many cases where there is a wise curb lane, motorists will not need to change lanes to pass a bicyclist. Also, more maneuvering room is provided when drivers are exiting from driveways or areas of limited sight distance. In general, a lane width of 14 feet (4.3m) from curb face to lane stripe is desired. Widths greater than 14 feet (4.3m) can encourage the undesirable operation of two motor vehicles in one lane, especially in urban areas.

Bicycle Routes—It may be advantageous to sign some urban and rural roadways as bicycle routes. When providing continuity to other bicycle facilities, a bicycle route can be relatively short. However, a bicycle touring route can be quite long. For long bicycle routes, a standard bicycle route marker with a numerical designation can be used in place of a bicycle route sign. It is often desirable to to use supplemental plaques with bicycle route signs or markers to furnish additional information, such as direction changes in the route and intermediate range distance and destination information.

Overall, the decision whether to provide a bicycle route should be based on the advisability of encouraging bicycle use on a particular road, instead of on parallel and adjacent highways. The roadway width, along with traffic factors (e.g., the volume and type of traffic, parking conditions, and sight distance), should be considered when determining the feasibility of a bicycle route. Roadway improvements, such as safe drainage grates, railroad crossings, smooth pavements, and signals responsive to bicycles, should always be considered before a roadway is identified as a bicycle route.

Further guidance on signing bicycle routes is provided in the MUTCD.

Bicycle Lanes—Bicycle lanes can be considered when it is desirable to delineate the rights-of-way assigned to bicyclists and motorists and to provide for more predictable movements by each. Bicycle lane markings can increase a bicyclist's confidence that motorists will not stray into his/her path of travel. Likewise, a passing motorist is less likely to swerve out of his/her lane to avoid hitting a bicyclist since the two have separate lanes.

Raised pavement markings and raised barriers present a hazard to bicyclists and should not be used to delineate bicycle lanes.

Bicycle lanes should always be one-way facilities and flow in the same direction as adjacent motor vehicle traffic. Two-way bicycle lanes on one side of the roadway are undesirable because they promote riding against the flow of traffic. Wrong-way riding is a major cause of bicycle accidents and is against the rules-of-the-road, as stated in the Uniform Vehicle Code. Bicycle lanes on one-way streets should be on the right side of the street, except in areas where a bicycle lane on the left will decrease the number of conflicts, such as those caused by heavy bus traffic.

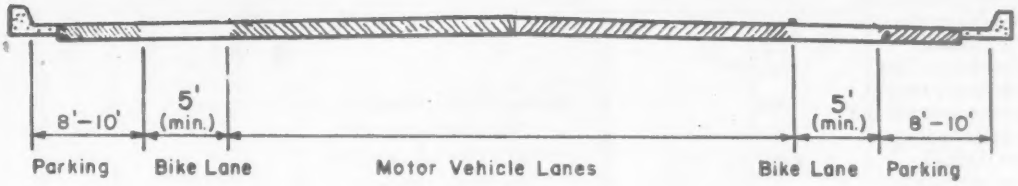
To examine the width requirements for bicycle lanes, it is important to look at the three usual locations for such a facility in relation to the roadway. Figure 1(a) depicts bicycle lanes on an urban curbed street where parking is permitted. Bicycle lanes should always be placed between the parking area and the travel way. Bike lanes between the curb and the parking area create hazards for bicyclists from opening car doors and poor visibility at intersections; therefore, this placement should never be considered. A minimum bicycle lane width for this location is 5 feet (1.5m). If parking volume is substantial or turnover is high, an additional 1 or 2 feet (0.3 or 0.6m) of width is desirable.

Figure 1(b) depicts bicycle lanes along the outer portions of an urban curbed street where parking is prohibited. Bicycle lanes in this location should have a minimum width of 4 feet (1.2m), but if a gutter pan exists, an additional 1 or 2 feet (0.3 or 0.6m) should be considered. Bicyclists do not generally ride in the gutter because of the possibility of debris, of hitting a pedal on the curb, of an uneven longitudinal joint, or of a steeper cross-slope. Therefore, a minimum width of 3 feet (0.9m) must be provided between the traffic lanes and the joint.

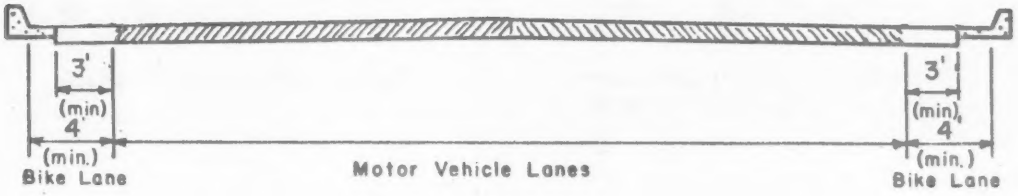
BILLING CODE 4910-22-M

Figure I

TYPICAL BIKE LANE CROSS SECTIONS



(a) CURBED STREET WITH PARKING



(b) CURBED STREET WITHOUT PARKING

(c) STREET WITHOUT CURB OR GUTTER

(Metric Conversion : 1 ft. = 0.3m)

BILLING CODE 4910-22-C

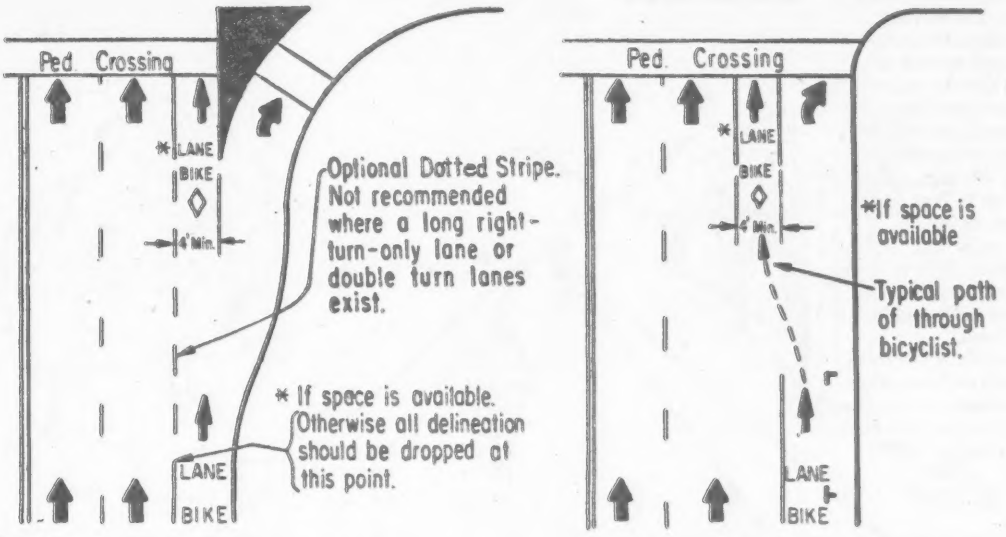
Figure 1(c) depicts bicycle lanes on a highway without curb or gutter. Bicycle lanes located between the motor vehicle lanes and the roadway shoulders should have a minimum width of 4 feet (1.2m). Additional widths are desirable when substantial truck traffic is present or when vehicle speeds exceed 35 m.p.h. (56km/h). When bicycle lanes are delineated on the shoulders, a width of 5 feet (1.5m) or greater is desirable.

The treatment of bicycle lanes at intersections should always be carefully considered. Studies have shown that the majority of bicycle/motor vehicle accidents occur at intersections. Two turning maneuvers in particular create most of the conflicts at intersections: the right-turning motorist conflict with through bicyclist and the through motorist conflict with the left-turning bicyclist.

BILLING CODE 4910-22-M

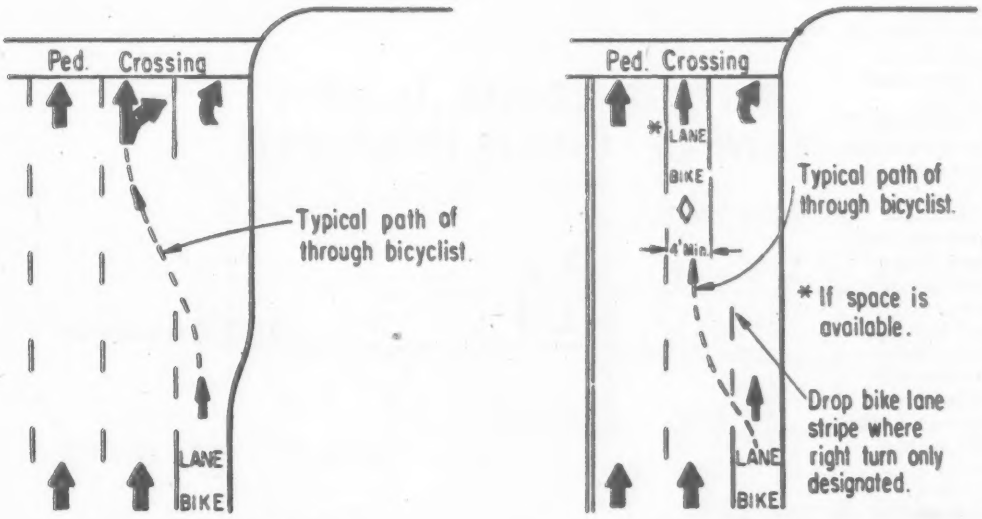
Figure 2

BIKE LANES APPROACHING MOTORIST RIGHT-TURN-ONLY LANES



RIGHT-TURN-ONLY LANE

PARKING AREA BECOMES RIGHT-TURN-ONLY LANE



OPTIONAL DOUBLE RIGHT-TURN-ONLY LANE

RIGHT LANE BECOMES RIGHT-TURN-ONLY LANE

(Metric Conversion: 1ft. = 0.3m)

BILLING CODE 4910-22-C

The design of bike lanes should include appropriate signing and marking at intersections to reduce the number of conflicts. General guidance for pavement marking of bicycle lanes is contained in the MUTCD. Figure 2 presents details on pavement markings for bike lanes approaching motorist right-turn-only lanes. When providing markings for left turns at intersections, it is important to consider the various ways that bicyclists make left turns. Some bicyclists merge across one or more lanes of traffic to use the inside lane or left-turn lane provided for motor vehicles. However, some bicyclists feel uncomfortable with this maneuver and will make a two-legged left turn, either by riding a course similar to that followed by pedestrians, or by dismounting and walking in the crosswalks as a pedestrian. Where there are numerous left-turning bicyclists, a separate turning lane, as indicated in the MUTCD, can be considered.

Adequate pavement surface, bicycle-safe grate inlets, safe railroad crossings, and traffic signals responsive to bicycles should always be provided on roadways where bicycle lanes are being designated.

Bicycle Paths

Bicycle paths are facilities with exclusive rights-of-way and with minimal cross flow by motorists. Bike paths can serve a variety of purposes.

They can provide a commuting bicyclist with a shortcut through a residential neighborhood. Located in a park, they can provide an enjoyable recreational opportunity. Bike paths can be located along abandoned railroad rights-of-way, the banks of rivers, and other similar areas. Appropriate locations can be identified during the planning process. The following sections give guidance for designing a safe and usable facility.

Width and Clearance—The paved width and the operating width required for a bicycle path are primary design considerations. Figure 3 depicts a two-way bicycle path on a separated right-of-way. Bicycle paths should have a minimum paved width of 8 feet (2.4m) for two-way traffic or 5 feet (1.5m) for one-way traffic. A 2-foot (0.6m) width graded area should be adjacent to both sides of the pavement. Under certain conditions it may be necessary to increase the width of a bike path to 10 or 12 feet (3 to 3.7m); for example, because of substantial bicycle volume, probably shared use with joggers and other pedestrians, use by large maintenance vehicles, excessive grades and recreational use where bicyclists will be likely to ride two abreat.

When the width of a bicycle path exceeds 8 feet (2.4m), the 2-foot (0.6m) graded areas may be reduced accordingly; however, a minimum of 3 feet (0.9m) in addition to the normal width is desirable for all paths to provide clearance from trees, poles, walls, fences, guardrails, or other lateral obstructions.

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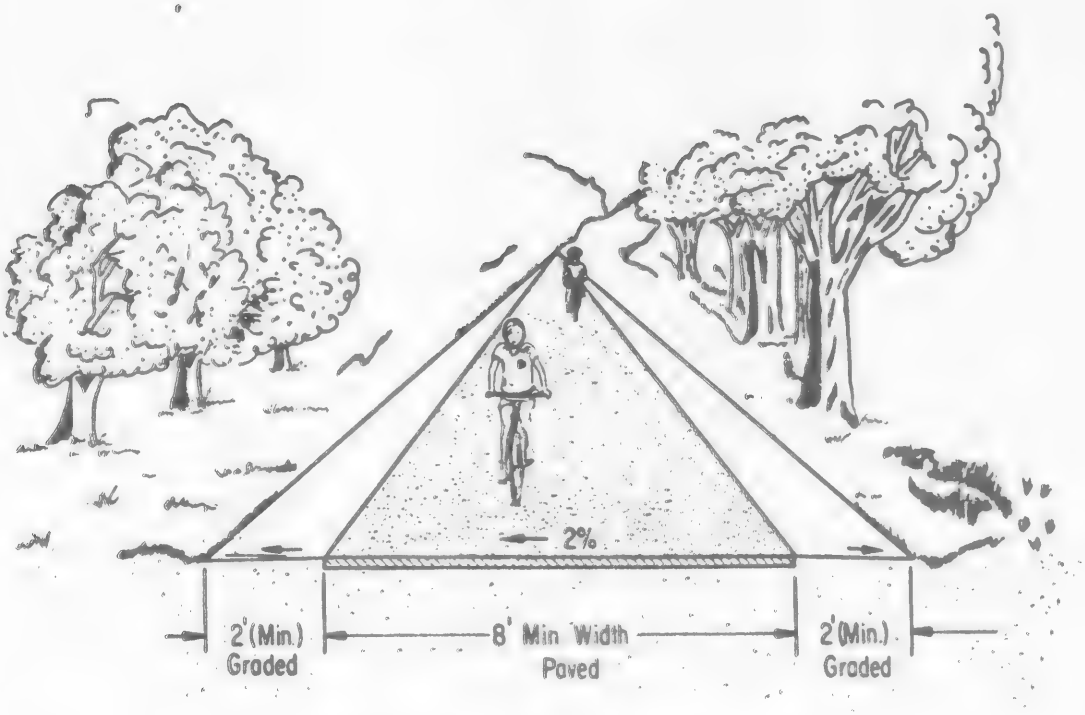
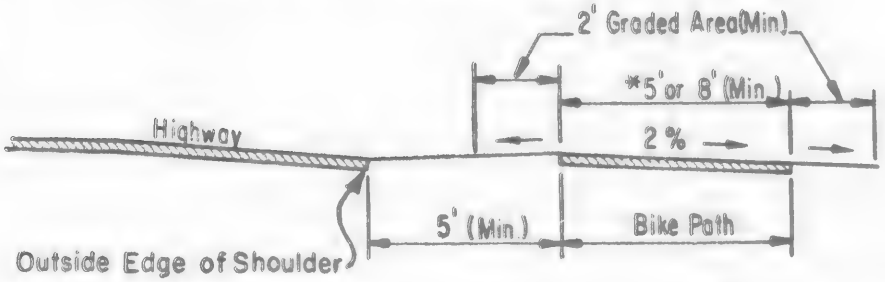
Figure 3

TWO-WAY BIKE PATH ON SEPARATED RIGHT-OF-WAY



TYPICAL CROSS SECTION BIKE PATH ALONG HIGHWAY



*One-Way: 5' Minimum Width
Two-Way: 8' Minimum Width
Metric Conversion: 1 ft. = 0.3m

BILLING CODE 4910-22-C

A wide separation between bicycle paths and adjacent roadways is desirable. When this is not possible and the clearance is less than 5 feet (1.5m), a physical divider is acceptable (e.g., a chain link fence, dense shrubs, or other high barriers that would prevent bicyclists from toppling over). Where motor vehicles can encroach onto the bike path, a positive barrier, such as a guardrail or concrete barrier, should be considered between the roadway and the bike path.

The vertical clearance to obstructions should be a minimum of 8.5 feet (2.6m).

Design Speed—The speed that a bicyclist travels is dependent on several factors, including the type of bicycle, the purpose of the trip, the condition and location of the bicycle path, and the physical condition of the bicycle and the rider. Bicycle paths should be designed for a selected speed that is at least as high as the preferred speed of the faster riders. In general, a design speed of 20 m.p.h. (32km/h) should be used; however, when the grade exceeds 4 percent, a design speed of 30 m.p.h. (48km/h) should be used. For exclusively recreational paths which are not paved and where bicyclists ride slower, a lower design speed of 15 m.p.h. (24km/h) can be used. Similarly, where the grade exceeds 4 percent on such paths, a higher design speed of 25 m.p.h. (40km/h) can be used.

Horizontal Alignment and Superelevation—The minimum radius of curvature should be consistent with the design speed of the bicycle path. The following table presents the design radius for various design speeds:

Design Radii

Design speed, mph (1 mph = 1.6km/h)	Design radius, feet (1 ft = 0.3m)
15	35
20	70
25	90
30	125

A cross slope should be a minimum of 2 percent to provide for drainage. On curves the percentage should be increased to 5 percent and be sloped in the direction of the inside of the curve, thus providing the semblance of superelevation.

Grade—Wherever possible, grades on bicycle paths should be kept to a minimum, especially on long inclines. A grade greater than 5 percent is undesirable; however, short grades greater than 5 percent are acceptable when a higher design speed or additional width is provided.

Sight Distance—To provide bicyclists with an opportunity to see and react to the unexpected, a bicycle path should be designed with adequate sight distances. Figure 4 indicates the minimum stopping sight distance for various design speeds and grades. For two-way bike paths, the sight distance in the descending direction will control the design. Sight distances should also be considered across the inside of horizontal curves. Figure 5 indicates the minimum clearance that should be used to line-of-sight obstructions for horizontal curves. The desired lateral clearance is obtained by entering Figure 5 with the stopping sight distance from Figure 4 and the proposed horizontal radius of curvature.

Intersections—Intersections are an important consideration in bicycle path design. If alternate locations for a bike path are available, the one with the most favorable intersection conditions should be selected. The ideal intersection treatment is a grade separation, but in may cases its cost is prohibitive.

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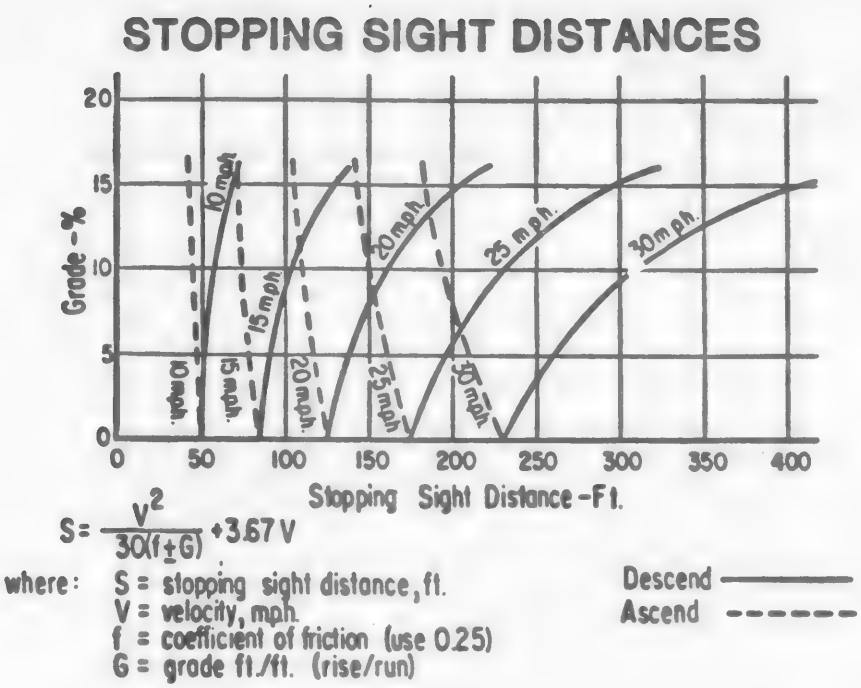
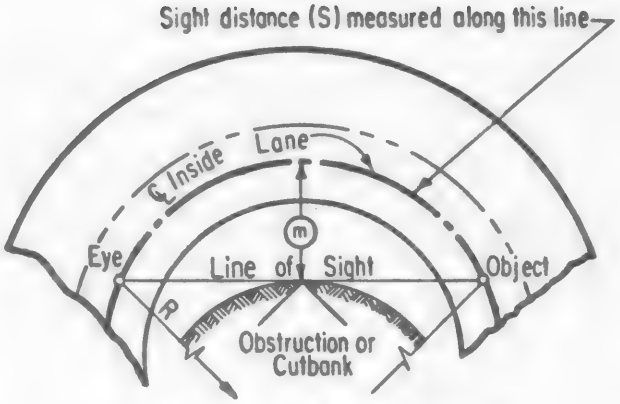
Figure . 4



(Metric conversion: 1 ft. = 0.3m, 1 mph = 1.6 km/h)

Figure 5

LATERAL CLEARANCES ON HORIZONTAL CURVES



Line of sight is 2.0' above ℄ inside lane at point of obstruction.

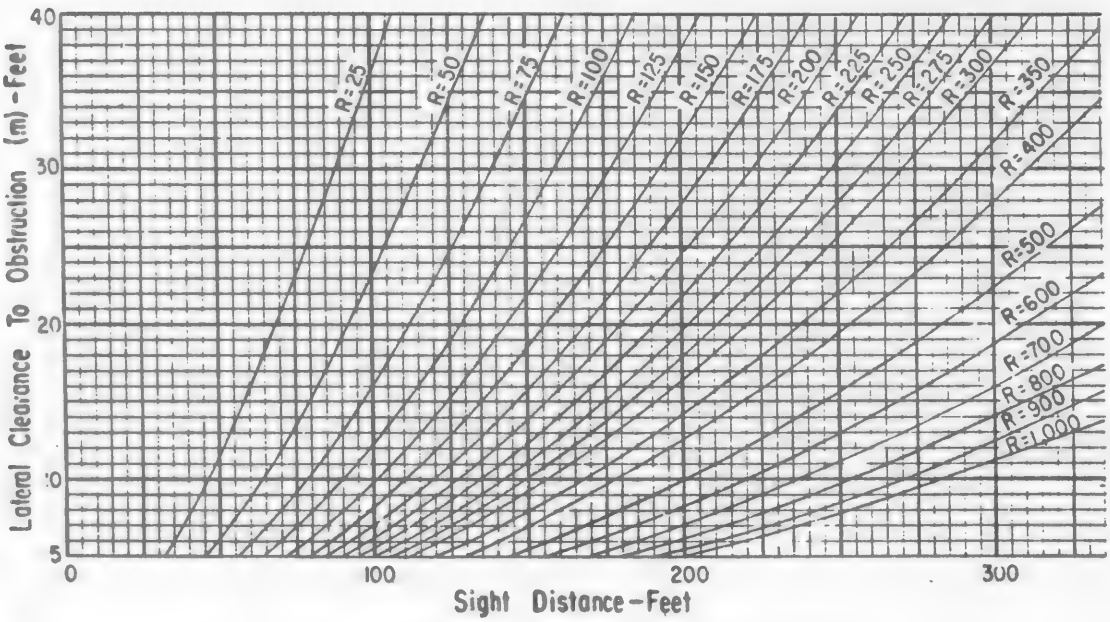
S = Sight distance in feet.
R = Radius of ℄ inside lane in feet.
m = Distance from ℄ inside lane in feet.
V = Design speed for S in mph.

Angle is expressed in degrees

$$m = R\left[\text{vers}\left(\frac{28.65S}{R}\right)\right]$$

$$S = \frac{R}{28.65}\left[\cos^{-1}\left(\frac{R-m}{R}\right)\right]$$

Formula applies only when S is equal to or less than length of curve.



(Metric conversion: 1ft. = 0.3m.)

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When intersections occur at grade, a major consideration is the establishment of right-of-way. At crossings with infrequent automobile traffic, such as residential driveways, bicycles should be given priority. Adequate sight distance and proper signing should be provided. Care should be given to ensure that bicycle path signs are located so that motorists are not confused by them.

The crossing of a highway should occur either at the pedestrian crossing or at a location away from any highway intersection so as to remove the hazard of turning vehicles. When crossing at mid-block locations, rights-of-way should be assigned by signs, marking and/or signals. Warrants and other requirements for signalization are contained in the MUTCD. At mid-block crossings on high-volume multilane arterial highways where signals are not warranted, consideration should be given to providing a median refuge area for crossing bicyclists.

Bicycle path intersections and approaches should be on flat grades. The maximum grade of the approaches should be 5 percent. Consideration can be given to a flat approach preceded by a short, steep, vertical section.

Curb-cuts at intersections should be the same width as the bicycle path. Curb-cuts and ramps should provide a smooth transition between the bicycle path and the roadway.

Signing and Marking—Adequate signing and marking are essential on bicycle paths, especially at railroad grade crossings and highway intersections. A designer can consider a centerline stripe to separate opposite directions of travel. This is particularly beneficial in the following circumstances: (1) for heavy volumes of bicycles, (2) on curves with restricted sight distance, and (3) on unlighted paths where nighttime riding is expected. General guidance for signing and marking of bike paths is provided in the MUTCD.

Pavement Structure—The basic criterion for the structural section of a bicycle path pavement is that it is adequate to support the wheel loads of bicycles and riders as well as maintenance vehicles or other types of motor vehicles which may use or cross the facility. Accordingly, the type of material an depth of the base course is of primary importance. Suitable materials for base courses include aggregates (e.g., gravel, crushed stone, slag), stabilized earth, soil cement, asphalt concrete, and Portland cement concrete. The path should be surfaced with a material which is stable and traversable even in wet weather. Surfaces should consist of a machine-laid asphaltic material or Portland cement concrete; however, under certain circumstances, a dense-graded surface of crushed aggregate, sand, clay, or stabilized earth may be acceptable.

Several combinations of the above materials are possible in designing the full structural section. One design that has been found satisfactory makes use of a full-depth, hot-mix asphalt pavement laid directly on the subgrade (Figure 6(a)). The total thickness may vary from 3 to 6 inches (80 to 150mm), depending on the quality of the subgrade. With this design, regular highway mixes can be used, provided they are dense-graded, i.e., not more than 10 percent air voids. A fine-graded aggregate should be used in the surface course to provide a smooth texture. As a rule, asphalt content should be one-half percent higher than that used on a regular highway mix, as the bicycle path will be subject to lighter loads.

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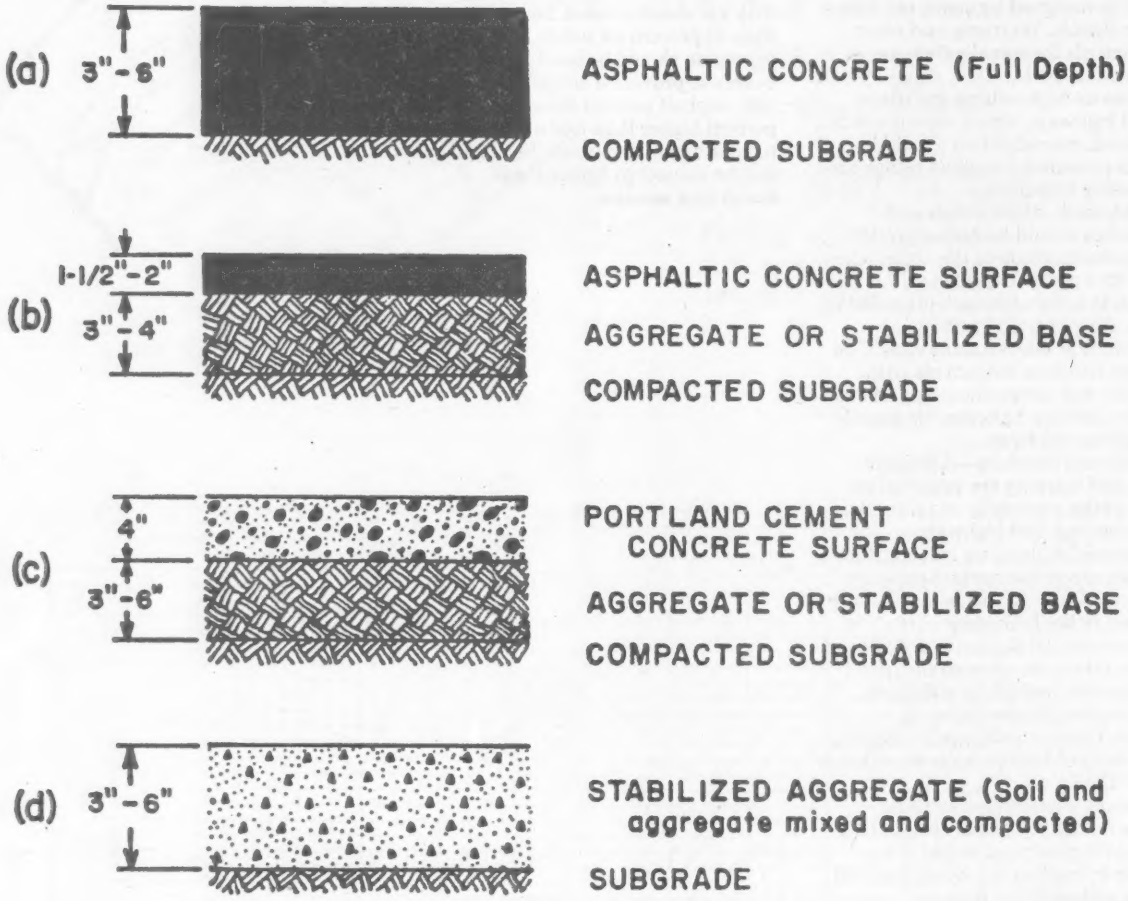
Figure 6

TYPICAL PAVEMENT STRUCTURAL SECTIONS FOR BIKE PATHS



(Metric conversion: 1 in. = 25 mm.)

BILLING CODE 4910-22-C

Another desirable structural section consists of a 3-inch (80mm) to 4-inch (100mm) aggregate base of either gravel, crushed stone or slag with a 1½-inch (40mm) to a 2-inch (50mm) asphalt surface course (Figure 6(b)). This pavement structure is usually preferable to the full-depth, hot-mix method, because it is more economical than the full-depth course when the bicycle path is placed on poor quality subgrade.

Portland cement concrete may be used for bicycle paths. A structural section of the type normally used for pedestrian walks is adequate for bicycle traffic, but a heavier section is necessary where maintenance vehicles use the path. A typical Portland cement concrete structural section is shown in Figure 6(c). Special treatment should be considered to develop a smoother surface than on the usual jointed sidewalk.

For paths intended exclusively for recreational travel, a dense-graded surface of crushed aggregate, sand, clay, or stabilized earth (see Figure 6(d)) may be acceptable and environmentally pleasing. This type of surface is less smooth than the other surfaces mentioned and will result in lowering operating speeds, which is desirable if the path will also be used by hikers and joggers. In areas where all-weather operation is expected, this type of surface can be undesirable. If used, some length of the path prior to any highway intersections should be paved to prevent material from being scattered on the highway.

The preceding discussion is intended as a general guide for the design of pavement structures for bicycle paths. Because of the wide variations in soils, loads, materials, and construction practices, it is not practical to present specific pavement designs that are applicable nationwide. Attention to the local governing conditions is needed, particularly where soils offer poor support and weather conditions are severe. Experience in highway pavement can assist in the choice of a proper bicycle path pavement structure and may identify energy-conserving practices such as the use of sulfur-extended asphalt, fused waste, or fly ash.

Structures—An overpass, underpass, small bridge or facility on a highway bridge may be necessary to provide continuity to a bicycle path. Where practicable the surfaced width of a bicycle path should be carried across or through these structures. Railings, fences or barriers should be considered for both sides of the bike path at a minimum height of 4.5 feet (1.4m). When a bicycle path is carried across a highway bridge, the barrier between the path and the roadway may be less if a highway shoulder is provided. Rub rails attached to the barriers at a handlebar height of 3.5 feet (1.1m) and made of smooth wood planking or similar material can be considered.

Drainage—The recommended minimum pavement cross slope of 2 percent adequately provides for drainage. Sloping in one direction instead of crowning is preferred and usually simplifies the drainage and surface construction. Where a bicycle path is constructed on the side of a hill, a ditch of dimensions suitable for the safety of bicyclists and for the volume of water expected should be placed on the uphill side to intercept the hillside drainage. Where necessary, catch basins with drains should be provided to carry the intercepted water under the path. To assist in draining the area adjacent to the bike path, the design should include considerations for preserving the natural ground cover. Seeding, mulching and sodding of adjacent slopes, swales and other erodible areas should be included in the design plans.

Lighting—Fixed-source lighting reduces bicycle/bicycle conflicts along the path and bicycle/motor vehicle conflicts at intersections. In addition, lighting allows the bicyclist to see the bike path direction, surface conditions, and obstacles. Lighting for bike paths is important and should be considered where riding at night is expected, such as bike paths serving college students or commuters, and at highway intersections. Lighting should also be considered through underpasses or tunnels, and when nighttime security could be a problem. Depending on the location, average maintained horizontal illumination levels of 0.5 foot-candle (5 lux) to 2 foot-candles (22 lux) should be considered. Where special security problems exist, higher illumination levels may be considered. Light standards (poles) should meet the recommended horizontal and vertical clearances. Luminaires and standards should be at a scale appropriate for a pedestrian or bicycle path.

Barriers—Bicycle paths often need some form of physical barrier at highway intersections to prevent motor vehicles from using the facility. Provisions can be made for a lockable, removable post to permit entrance by authorized vehicles. This carrier should be permanently reflectorized and designed to give safe access for bicycles. When more than one post is used, a 5-foot (1.5m) spacing is desirable.

Multi-use—In general, multi-use paths are undesirable; bicycles and pedestrians do not mix well. Whenever possible, separate paths should be provided; however, if this is not feasible, additional width, signing or striping should be used to minimize conflicts.

Providing a sidewalk bike path is unsatisfactory for a variety of reasons. Sidewalks are typically designed for pedestrian speeds and are not safe for higher-speed use. Conflicts are common between pedestrians traveling at low speeds (or exiting stores, parked cars, etc.) and bicyclists, as are conflicts with fixed objects (e.g., parking meters, utility poles, sign posts, bus benches, trees, fire hydrants, mail boxes, etc.). At intersections, motorists are often not looking for bicyclists (who are traveling at higher speeds than pedestrians) entering the crosswalk area, particularly when motorists are making a turn. Sight distance is often impaired by buildings, walls, property fences, and shrubs along sidewalks, especially at driveways.

Bicycle riding on sidewalks can be expected in residential areas with young children. With lower bicycle speeds and lower motor vehicle speeds, potential conflicts are somewhat lessened, but still exist. This type of sidewalk bicycle use is generally accepted, but it is inappropriate to sign sidewalks as bike paths.

Using a path for bicycles and horses creates an unsatisfactory and possibly dangerous mix. A horse startles easily and may kick out suddenly if it perceives the bicyclist as a danger. A bicycle path and a bridle path are also incompatible in their surface design requirements. Bicycles function best on hard surfaces; horses function best on soft surfaces. A compromise to accommodate both uses would result in a less than adequate surface for both.

Supplemental Facilities

Providing bicycle parking facilities is an essential element in an overall effort to promote bicycling. People are discouraged from bicycling unless adequate parking is available. Bicycle parking devices should be provided at both the trip origin and the trip destination and should offer protection from theft and damage.

The wide variety of bicycle parking devices fall into two categories of user needs: commuter or long-term parking, and convenience or short-term parking. The minimum needs for each differ in their placement and protection. Long-term parking is needed at locations such as employment centers, transit or subway stations, and multifamily dwellings. Facilities should be provided which secure both wheels and

accessories and which offer protection from the weather. Bike lockers and attending storage areas are good examples of long-term parking facilities. Short-term parking is needed at locations such as shopping centers, libraries, recreation areas, and post offices. Facilities should be very convenient and be near building entrances or other highly visible areas which are self-policing. If bicycle parking is not properly designed and located, bicyclists will use trees, railings, and other appurtenances. This practice can damage the appurtenances and create a hazard for pedestrians.

Several factors should be considered when planning and providing bicycle parking facilities. Care should be given in selecting the location to ensure that bicycles will not be damaged by automobiles. Parking facilities should not interfere with the normal pedestrian flow. Also, facilities should be adequately spaced so that persons parking their bicycles will not disturb other parked bicycles. Facilities should be able to accommodate a wide range of bicycle shapes and sizes. Finally, facilities should be simple to operate. If possible, signs depicting how to operate the facility should be posted.

In addition to bicycle parking facilities, there are several other improvements that complement bike paths and roadway improvements. Provisions can be considered for interfacing bicycle travel with public transit, such as racks on buses, or buses converted to carry bikes aboard. Printing and distributing a bicycle map is a high-benefit, low-cost project that is easily accomplished. Maps could identify bikeways, parking facilities, and roads not marked or signed but suitable for bicycling. Also, a map could point out narrow, high-speed, or high-volume roads, barriers, and other problems to bicyclists.

Chapter 3—Operation and Maintenance

The agency responsible for the control, maintenance, and policing of bicycle facilities should be established prior to construction. The costs involved with the operation and maintenance should be considered when planning a facility. Neglected maintenance will render bicycle facilities unrideable, and the facilities will become a liability to the State or community. Bicyclists should be encouraged to report bike paths and roadways needing maintenance.

Bicycle paths need a regular schedule of policing and maintenance. Enforcement is usually necessary to prevent motor vehicles from using a bike path. The pavement surface of a path should be kept clean by sweeping. Attention should be given to maintaining the full paved width and not allowing the edges to ravel. Trees, shrubs, and other vegetation should be controlled to provide adequate clearances and sight distances. Sufficient trash receptacles should be placed and maintained at convenient locations. Seeded and sodded areas in the vicinity of bicycle paths should have a regular schedule of mowing.

Bicycle routes, bicycle lanes, and other roadways with bicycle traffic are often susceptible to having debris, such as glass or sand, collect in the area where bicyclists ride. A smooth surface, free of potholes and debris, should be provided. The pavement edges should be uniform. Bicycle signs and markings should be inspected regularly and kept in good condition. Highways with bicycle traffic may require more frequent maintenance than other highways.

The routine maintenance of roadways provides an excellent opportunity to improve the bicycle travel on those roads. Several bicycle facilities described in this guide can be implemented during routine maintenance activities. When lane markings for four- or six-lane streets are restriped, consideration can be given to adjusting the lane widths and providing a wide outside curb lane for bicycles. When shoulders are resurfaced, a smooth surface suitable for bicycle riding should be considered.

Appendix

Review of Legal Status

Bicycle programs must reflect local laws and ordinances. Bicycle facilities must not encourage or require bicyclists, pedestrians, or motorists to operate in a manner inconsistent with the adopted rules of the road.

The National Committee on Uniform Traffic Laws and Ordinances, a group of more than 140 individuals involved in the complex problems of highway transportation, has developed and recommended the Uniform Vehicle Code (UVC) as a comprehensive guide or standard for State motor vehicle and traffic laws. In addition, the provisions of the Model Traffic Ordinance (MTO) have been designed as a guide or standard for municipalities to follow in reviewing their traffic ordinances or considering the development or revision of a model traffic ordinance. Since bicycles are defined as vehicles, familiarity with the provisions in the UVC and MTO is important when developing bicycle facilities. The following are some of the UVC provisions relating to bicycle facilities:

11–1202—Traffic Laws Apply To Persons on Bicycles and Other Human-Powered Vehicles

"Every person propelling a vehicle by human power or riding a bicycle shall have all of the rights and all of the duties applicable to the driver of any other vehicle under chapters 10 and 11, except as to special regulations in this article and except as to those provisions which by their nature can have no application."

11–201—Obedience to and Required Traffic Control Devices

"(a) The driver of any vehicle shall obey the instruction of any official traffic control device applicable thereto placed or held in accordance with the provisions of this act, unless otherwise directed by a police officer, subject to the exceptions granted the driver of an authorized emergency vehicle in this act."

1–158—UVC Definition of Roadway

"That portion of a highway improved, designed or ordinarily used for vehicular travel, exclusive of the sidewalk, berm or shoulder even though such sidewalk, berm or shoulder is used by persons riding bicycles or other human-powered vehicles. In the event a highway includes two or more separate roadways the term 'roadway' as used herein shall refer to any such roadway separately but not all such roadways collectively."

11–1205—Position on Roadway

"(a) Any person operating a bicycle or a moped upon a roadway at less than the normal speed of traffic at the time and place and under the conditions then existing shall ride as close as practicable to the right-hand curb or edge of the roadway except under any of the following situations:

(1) When overtaking and passing another bicycle or vehicle proceeding in the same direction.

(2) When preparing for a left turn at an intersection or into a private road or driveway.

(3) When reasonably necessary to avoid conditions including, but not limited to, fixed or moving objects, parked or moving vehicles, bicycles, pedestrians, animals, surface hazards, or substandard width lanes that make it unsafe to continue along the right-hand curb or edge. For purposes of this section a 'substandard width lane' is a lane that is too narrow for a bicycle and a vehicle to travel safely side by side within the lane.

(b) Any person operating a bicycle or a moped upon a one-way highway with two or more marked traffic lanes may ride as near the left-hand curb or edge of such roadway as practicable."

11–1205.1—Use of Bicycle Paths

"(b) Wherever a usable path for bicycles has been provided adjacent to a roadway bicycle riders shall use such path and shall not use the roadway."

11–1209—Bicycles and Human-Powered Vehicles on Sidewalks

"(a) A person propelling a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall yield the right of way to any pedestrian and shall give audible signal before overtaking and passing such pedestrian.

(b) A person shall not ride a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, where such use of bicycles is prohibited by official traffic control devices.

(c) A person propelling a vehicle by human power upon and along a sidewalk, or across a roadway upon and along crosswalk, shall have all the rights and duties applicable to a pedestrian under the same circumstances."

11–1210—Bicycle Parking

"(a) A person may park a bicycle on a sidewalk unless prohibited or restricted by an official traffic control device.

(b) A bicycle parked on a sidewalk shall not impede the normal and reasonable movement of pedestrians or other traffic.

(c) A bicycle may be parked on the roadway at an angle to the curb or edge of the roadway at any location where parking is allowed.

(d) A bicycle may be parked on the roadway abreast of another bicycle or bicycles near the side of the roadway at any location where parking is allowed.

(e) A person shall not park a bicycle on a roadway in such a manner as to obstruct the movement of a legally parked motor vehicle.

(f) In all other respects, bicycles parked anywhere on a highway shall conform with the provisions of article 10 regulating the parking of vehicles."

11–313—Restrictions on Use of Controlled Access Roadway

"(a) The (State highway commission) by resolution or order entered in its minutes, and local authorities by ordinance, may regulate or prohibit the use of any controlled access roadway (or highway) within their respective jurisdictions by any class or kind or traffic which is found to be incompatible with the normal and safe movement of traffic.

(b) The (State highway commission) or the local authority adopting any such prohibition shall erect and maintain official traffic control devices on the controlled access highway on which such prohibitions are applicable and when in place no person shall disobey the restrictions stated on such devices."

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